

ELECTRICAL ENGINEERING HALL OF FAME

EDWARD V. APPLETON

In 1962, the Institute of Radio Engineers (IRE) awarded its Medal of Honor to Edward V. Appleton (Fig. 1). He was cited “for his distinguished pioneer work in investigating the ionosphere by means of radio waves.” He spent most of his professional career in teaching and research at the University of London and at Cambridge University. He was the author of approximately 140 scientific papers, primarily on the physics of the upper atmosphere. An interesting footnote to his Medal of Honor award is that he had received the Nobel Prize in Physics 15 years earlier.

I. ACADEMIC EXPERIENCE

Edward Victor Appleton was born September 6, 1892 in Bradford, U.K. After two years at the University of London, he received a scholarship which enabled him to continue his education at Cambridge University. He graduated from Cambridge with first-class honors in physics in 1913. He remained at Cambridge for postgraduate work under William Lawrence Bragg. In 1915, Bragg shared the Nobel Prize in Physics with his father, William Henry Bragg, for their research on the structure of crystals using X-rays.

The outbreak of the World War I interrupted Appleton's education. During the war, he served as a signal officer in the Royal Engineers and developed an interest in the propagation of radio waves. After the war, he came back to Cambridge to continue his research at the famous Cavendish Laboratory.



Fig. 1. IRE President Patrick Haggerty presenting the 1962 IRE Medal of Honor to Edward V. Appleton (IEEE History Center).

The Institute of Radio Engineers awarded its 1962 Medal of Honor to Edward V. Appleton “for his distinguished pioneer work in investigating the ionosphere by means of radio waves.”

He worked closely for a time with Balthazar van der Pol who later received the IRE Medal of Honor in 1935. Van der Pol was cited for “his fundamental studies and contributions in the field of circuit theory and electromagnetic wave propagation phenomena.”

Appleton was the coauthor with Mary Taylor of an IRE paper titled “On optimum heterodyne reception” published in the *Proceedings of IRE* in June 1924. The same year, Appleton was appointed Wheatstone Professor of Physics at the University of London, a position he held until 1936. He was elected a Fellow of the Royal Society of London in 1927. During the 1920s, he and some of his students did considerable research on electronic tubes which provided the basis for his



Fig. 2. Arthur E. Kennelly
(IEEE History Center).

book titled *Thermionic Vacuum Tubes* published in 1932.

II. IONOSPHERE RESEARCH

Early in 1925, Appleton disclosed the results of recent experiments on the effects of the upper atmosphere on the propagation of radio waves. With the assistance of Miles A. F. Barnett, a graduate student from New Zealand, Appleton had recorded and analyzed radio signals from a British Broadcasting Company (BBC) transmitter located at Boumemouth. By varying the frequency of the transmitter and studying the interference between ground waves and sky waves, Appleton determined that the height of the Kennelly–Heaviside layer of the ionosphere was about 60 miles above earth. Arthur E. Kennelly (Fig. 2) in the United States and Oliver Heaviside (Fig. 3) in the United Kingdom had independently predicted the existence of a reflecting layer in 1902, but Appleton was the first to provide convincing evidence of its height and other properties.

In July 1925, Merle A. Tuve of Johns Hopkins University and Gregory Breit of the Carnegie Institution

reported confirmation of Appleton's ionospheric measurements. They had used a somewhat different technique with a transmitter designed to generate radio-frequency pulses with long intervals. The measured time between a transmitted pulse and a received echo enabled an accurate determination of the height of the Kennelly–Heaviside layer. A similar technique was later adopted by Robert Watson-Watt (Fig. 4) and others in the design of radar systems. Appleton soon adopted the American pulse technique for his continuing research on the ionosphere. He identified what were sometimes called the “Appleton layers,” also known as the *D* and *F* layers. He collected data on the ionization density of the layers and the variations as a function of the time of day and season of the year.

III. AWARDS AND LEGACY

Appleton received the Morris N. Liebmann Memorial Award from the IRE in 1929 “for his investigations in the field of wave propagation.” He was elected a Fellow of the IRE in 1931. He received the Faraday medal from the British Institution of Electrical Engineers and the Hughes



Fig. 3. Oliver Heaviside (IEEE History Center).



Fig. 4. Robert Watson-Watt
(IEEE History Center).

Medal from the Royal Society of London. He was the coauthor with Sydney Chapman of an IRE paper titled “Report on ionization changes during solar eclipse” published in June 1935.

In 1936, Appleton was appointed Jacksonian Professor of Natural Philosophy at Cambridge University. The position included a laboratory for his atmospheric research. He founded the *Journal of Atmospheric and Terrestrial Physics* and served as its editor. He became a member of the government Department of Scientific and Industrial Research in 1939 and participated in the management of British research and development of radar and nuclear research during World War II. He was honored with a knighthood in 1941. Soon after receiving the Nobel Prize in 1947, he was elected to an administrative position at Edinburgh University. He participated in planning scientific projects for the International Geophysical Year in 1957. He died April 21, 1965, at age 72. A biography of Appleton by Ronald Clark was published in 1971. ■

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